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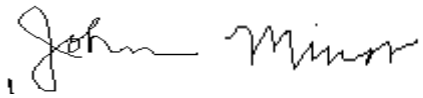
ATTACHMENT 6

RFPSat Program

Ground Mission Requirements Document (GMRD)

October 1, 2003

APPROVALS



_____Date: 10/1/03
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TABLE OF CONTENTS

1 Introduction

1.1 Purpose and Scope

The purpose of this RFPSat Ground Mission Requirements Document (GMRD) is to provide an initial description of the ground system capabilities (engineering and operations) required to successfully support the RFPSat mission. The scope of this document includes all aspects of communicating with the RFPSat space vehicle including, but not limited to: Telemetry Tracking & Command (TT&C), experiment and spacecraft state-of-health (SOH), and experiment science data. The requirements specified in this document allow Det 12/VO to generate a planning estimate for mission engineering and operations to be provided to the RFPSat Mission Program Office (Det 12/ST). This GMRD contains requirement for both the Space Test and Engineering Contract (STEC) and the Engineering, Development and Sustainment (EDS) contractors.

1.2 Approval and Revisions

Det 12/ST will be the Approval Authority for this RFPSat GMRD. Once the GMRD is approved, all updates to this document will be incorporated into the Ground Specification Document (GSD).

1.3 Applicable Documents

None

1.4 Conventions and Nomenclature

In this document, the following nomenclature and conventions shall apply:

Items that are numbered and italicized are RFPSat requirements being levied on VO. The contractor (STEC or EDS) that is responsible for fulfilling each requirement is indicated in parenthesis after each requirement. Descriptive information is included in each section to provide background and rationale for the requirements. The roles and responsibility section should be used to assist VO in determining the scope of the work to be done.

Spacecraft (SC) refers to the summation of hardware and software that provides the required resources and environmental controls to the experiment during launch and on-orbit operations. This is also referred to as the "bus". The term space vehicle (SV) refers to the SC plus the integrated experiment. The term RFPSat is synonymous with the term "Space Vehicle."

The term "spacecraft contractor" refers to the prime contractor (SatBuilder Corporation) for the bus and its subcontractors.

The term "Research, Development, Test, and Evaluation (RDT&E) Support Complex (RSC)," refers to the equipment, software, and the physical facilities used for satellite operations.

The term "Det 12/VO," or "VO," refers to a Detachment within the Space and Missile Systems Center, Air Force Space Command that is responsible for operating the RSC. The RSC and Det 12/VO cannot be used interchangeably; Det 12/VO is an organization and the RSC is a facility.

For the purposes of this document, the term, "Space Test Program (STP)" is synonymous with "Det 12/ST." The term, "RFPSat Satellite Program Office (SPO)" is STP. The director of Det 12/ST is also known as the "Program Director." A representative for the Mission Director (MDR) during On-Orbit Operations as well as rehearsals and training is designated the "Mission Director Representative."

The term "Mission Control Team (MCT)" refers to the VO staff. They perform the day-to-day planning, monitoring, and commanding of the spacecraft. All hands-on activities are performed by the MCT.

The term "Mission Control Force (MCF)" refers to the combination of VO MCT, ST, Aerospace, MDR, PI's, and the spacecraft contractor personnel.

The term "Air Force Satellite Control Network (AFSCN)" refers to the antennas, control nodes and communications lines used for Space Ground Link System (SGLS) commanding and data retrieving.

1.5 Mission Description

RFPSat will be launched on a Minotaur from Vandenberg AFB into a sun synchronous 800 km circular orbit in October 2006.

1.5.1 Spacecraft Brief Description

The RFPSat spacecraft bus is being constructed by SatBuilder Corporation and is a 3-axis stabilized spacecraft. It has deployable and body mounted solar arrays and is power positive in all attitudes (pre- and post- solar array deployment). RFPSat is primarily a single-string space vehicle. The on-board TT&C system includes the capability to uplink commands via SGLS S-Band and the ability to downlink SV data via SGLS and X-Band. The Space Vehicle Handbook will describe all subsystems in detail and should be referenced for final design.

1.5.2 Experiment Brief Descriptions

1.5.2.1 Experiment 1 (Prime Experiment)

Experiment 1 is a high-resolution gimbaled hyper spectral imager implementing onboard data compression. Experiment 1 has three operating modes: calibration, image and standby. The calibration of the instrument will occur every six months during the mission and involve uploads of calibration parameters. After Launch and Early Orbit (L&EO), the experiment will be in Image Mode for five consecutive days each month for the duration of the mission. Image Mode requires rapid upload of experiment command data and quick turnaround of retrieved experiment data. The experiment image target uploads will be received by VO at any time during the 5 consecutive days but will be received at least 12 hours prior to the imaging event. A commercial X-Band provider will be used to capture this high rate experiment data in addition to SGLS low rate experiment data. The experimenter has a direct link to the X-Band provider to retrieve the X-Band data. When not imaging or calibrating, the experiment will be in Standby Mode.

1.5.2.2 Experiment 2

Experiment 2 is a demonstration of a new onboard processor that detects and corrects bit errors. Once turned on, this experiment will run continuously for the life of the mission with quarterly memory uploads and daily downloads of experiment data.

1.5.2.3 Experiment 3

Experiment 3 is a new demonstration of micro-electronic technology. This free-flying experiment, which is ejected from the space vehicle, will be used to perform a visual inspection of the RFPSat spacecraft. All telemetry collection and commanding, with the exception of the eject command, will be performed by the experimenter using an independent ground station located in Colorado Springs, CO. This experiment will be released 11 months into the mission and will require two days of special operations.

1.5.3 Mission Timeline

RFPSat is scheduled to launch on a Minotaur launch vehicle from Vandenberg in October 2006. All experiments will be powered off during launch.

The L&EO period for RFPSat has been defined as not greater than the first 30 days on orbit with minimum mission duration of two years including the L&EO phase.

2 Mission Operations requirements

2.1 Mission Operations Overview

2.2 Spacecraft Operations

The following requirements are applicable for all phases of the mission.

MO01: *VO shall contact RFPSat space vehicle at least every eight hours via the AFSCN to ensure mission state-of-health. (STEC)*
MO02: *VO shall detect, respond to, document, and report SV anomalies. (STEC)*
MO03: *VO shall provide at least 35 minutes per day of SGLS low-rate experiment data downlink time. (STEC)*
MO04: *VO shall monitor real-time SOH for out of limit conditions and execute contingencies as specified in the On-Orbit Handbook (OOH). (STEC)*
MO05: *For the life of the mission, VO shall trend spacecraft SOH and stored SOH using the spacecraft contractor-provided trending tool. (STEC)*

2.2.1 Launch and Early Orbit

MO06: *VO shall be staffed to support the L&EO Phase up to 7 days a week, 24 hours a day for up to 30 days. (STEC)*
MO07: *VO shall collect SV SOH data within three hours of orbit insertion to ascertain the status of deployment and SV state of health. (STEC)*

2.2.2 Normal Operations

MO08: *VO shall trend the spacecraft clock drift and update the clock as necessary. (STEC)*
MO09: *VO shall not allow the stored SOH data to age beyond 18 hours before it is downlinked. (STEC)*

2.3 Experiment Operations

2.3.1 Launch and Early Orbit

All experiments will be powered off during launch. Specific activities for L&EO will be contained in the OOH.

2.3.2 Normal Operations

2.3.2.1 Experiment 1

PO01: *VO shall upload experiment targets within 8 hours of an imaging event. (STEC)*
PO02: *VO shall schedule and coordinate with the commercial X-Band provider, the high-rate experiment data downloads during Experiment 1 monthly imaging events. (STEC)*
PO03: *VO shall dump SGLS low-rate experiment data during monthly imaging events. (STEC)*
PO04: *VO shall upload calibration tables every six months during the mission. (STEC)*
PO05: *VO shall command Experiment 1 into standby mode when it is not in image or calibration mode. (STEC)*

2.3.2.2 Experiment 2

PO06: *Up to four times a year, VO shall upload Experiment 2 memory uploads. (STEC)*
PO07: *VO shall dump Experiment 2 data daily. (STEC)*

2.3.2.3 Experiment 3

PO08: *VO shall coordinate with the Experiment 3 ground station during release of Experiment 3. (STEC)*
PO09: *VO shall release Experiment 3 in sight of both an AFSCN ground station and the Experiment 3 ground system. (STEC)*

2.4 Data Quality Requirements

The goal for recovering experiment data recorded on the spacecraft is 100%. However, there are no data quality requirements on Experiment 1 X-Band data. Experiment 3 does not have any data quality nor data latency requirements since the RSC does not receive any telemetry from this experiment.

DQ01: *During Experiment 1 Image Mode operations, VO shall retrieve 100% of Experiment 1 SGLS low-rate data recorded on the spacecraft (calculated on a per day basis). (STEC)*
DQ02: *During Calibration Mode, VO shall receive 80% of Experiment 1 SGLS low-rate data recorded on the spacecraft (calculated on a per day basis). (STEC)*
DQ03: *During normal operations, VO shall retrieve 80% of Experiment 2 SGLS low-rate data recorded on the spacecraft (calculated on a per day basis). (STEC)*

2.5 Data Latency Requirements

DL01: *During Imaging Mode, VO shall make SGLS low-rate Experiment 1 data available to the experimenter within 6 hours of ground receipt. (STEC)*
DL02: *During Calibration Mode, VO shall make Experiment 1 SLGS low-rate data available to the experimenter within 24 hours of ground receipt. (STEC)*
DL03: *During normal operations, VO shall make Experiment 2 SGLS low-rate data available to the experimenter within 24 hours of ground receipt. (STEC)*

3 Organizational Description

3.1 Organization

This section describes the organizations involved in the RFPSat operations, their roles and responsibilities for the mission.

- Det 12/ST will fund Det 12/VO to execute RFPSat flight readiness activities and two years of operations. Det 12/ST is responsible for the overall mission.
- If extended mission operations (beyond two years) are desired, the experiment organizations may fund Det 12/VO to operate RFPSat, or they may fund Det 12/VO to transition operations to another organization.
- Det 12/VO is the operations execution organization.
- SatBuilder Corporation will build the spacecraft, integrate the experiments, and provide technical expertise concerning the space vehicle under the direction of Det 12/ST.
- The experimenter will support experiment checkout, operations, and anomaly resolution.

3.2 Roles and Responsibilities

3.2.1 ST Roles and Responsibilities

3.2.1.1 Pre-Mission

- Provide an interface between the spacecraft contractor, experimenters, and Det 12/VO for RFPSat operations planning, pre-flight compatibility/verification tests, and two years of on-orbit operations support.
- Lead weekly Mission Operations Integrated Product Team (IPT) teleconferences.
- Lead Mission Operations Working Groups (MOWGs).
- Participate in rehearsals and compatibility tests as the MDR.
- Plan, coordinate, and lead the SV-to-RSC Factory Compatibility Test (FCT) and Launch Base Compatibility Test (LBCT).
    - Provide all support and deliverables IAW the agreed-upon RSC Readiness schedule.

3.2.1.2 Launch and Early Orbit

- Serve as Mission Director and provide MDRs.
- Lead the MCF.
- Serve as the interface between experimenters, spacecraft contractor, and Det 12/VO.
- Coordinate all memograms and pass plans between the MCF.
- Chair anomaly meetings.
- Assess the contractual and mission impact of anomalous SV performance.

3.2.1.3 Normal Operations

- Serve as Mission Director and provide MDRs.
- Resolve conflicts among spacecraft contractor, the experiment, and Det 12/VO.
- Lead anomaly resolution efforts, as required.
- Approve changes to priorities required to resolve mission anomalies.

3.2.1.4 End-of-Life Operations

- Ensure End-of-Life plan is executed at the termination of the mission.
- Give the final Go/No Go decision as to when this plan is implemented.

3.2.2 Spacecraft Contractor Roles and Responsibilities

3.2.2.1 Pre-Mission

- Analyze, design, manufacture, and test SC; integrate experiments; and test the SV.
- Participate in weekly Mission Operations IPT teleconferences.
- Participate in MOWGs.

- Provide AFSCN Program Requirement Document (PRD) inputs related to the required spacecraft design to VO.
- Provide GSD and Ground Interface Control Document (GICD) inputs for VO development of RSC interface documentation.
- Develop and publish OOH, Space Vehicle Handbook (SVH), and Command and Telemetry Handbook (CTH).
- Provide inputs and review RSC-developed telemetry displays.
- Provide training to operations personnel to operate the SV safely.
- Provide input to ST test plan for the FCT and LBCT.
- Support rehearsal planning by providing a representative on the rehearsal committee to assist in the generation of scripts and anomalies.
- Make spacecraft simulator (required) and SC (goal) available for RSC database/software checkout and rehearsals.
- Participate in rehearsals.
- Support VO in normal and contingency operations pass plan development and review.
- Review and sign off on all L&EO pass plans prior to execution.

3.2.2.2 Launch and Early Orbit

- Provide spacecraft command uploads as required.
- Provide vehicle, subsystems, and operations technical advisors in the RSC during L&EO.
- Evaluate SC telemetry (both real-time and post pass) to assess SC health.
- Participate in SV anomaly resolution efforts and recommend modifications to pass plans and/or contingency plans as required.
- Write and submit memograms for permanent SV operations changes.

3.2.2.3 Normal Operations

- Provide contractor personnel support throughout the first year of operations.
- Support VO in pass plan development and review cycle (when necessary).
- Develop and/or review SV memograms.
- Provide commanding data such as code uploads and command sequences as required.
- Participate in SV anomaly resolution efforts and recommend modifications to pass plans and/or contingency plans as required.
- Periodically evaluate SV telemetry based on trending plots and stored SOH provided by VO.
- Write and submit memograms for permanent procedural changes.

3.2.3 Experiment Organization Roles and Responsibilities

3.2.3.1 Pre-Mission

- Participate in weekly Mission Operations IPTs.
- Participate in MOWGs.
- Support mission planning by defining experiment success criteria and operational requirements, constraints, and operating procedures.
- Provide GSD and GICD inputs for experiment-specific items.
- Deliver experiment-specific inputs to spacecraft contractor for the SVH and OOH.
- Develop and deliver to spacecraft contractor all necessary experiment command and telemetry database information.
- Provide inputs to and review the RSC telemetry displays.
- Provide experiment inputs and engineering support for the FCT, LBCT and other operations-related functional testing.
- Provide experiment training to VO personnel to safely operate the experiment.
- Support ST and VO in the planning and conduct of mission operation exercises and rehearsals.
- Participate in operations rehearsals.
- Support VO in pass plan development and review.
- Provide all support and deliverables IAW the agreed-upon RSC Readiness schedule.

3.2.3.2 Launch and Early Orbit

- Support VO in pass plan development and review.
- Provide experiment technical advisors.
- Provide experiment commanding inputs as required.
- Lead experiment anomaly resolution efforts.
- Participate in SV anomaly resolution efforts and recommend modifications to pass plans and/or contingency plans as required.

3.2.3.3 Normal Operations

- Support VO in pass plan development and review.
- Provide experiment commanding inputs as required.
- Lead experiment anomaly resolution efforts.
- Participate in SV anomaly resolution efforts and recommend modifications to pass plans and/or contingency plans as required.
- Notify VO of data reception/status problems.

3.2.4 Det 12/VO Roles and Responsibilities

3.2.4.1 Pre-Mission (STEC)

- Conduct reviews, provide schedules, and status of RFPSat readiness activities and RSC development.
- Develop an operations concept meeting GSD, GICD, and AFSCN requirements.
- Develop MUS to enable the RSC ground system to meet GSD, GICD, and AFSCN requirements.
- Participate in weekly Mission Operations IPT teleconferences.
- Participate in MOWGs.
- Develop the GICD defining the RSC to SV interface and the product exchange interface.
- Develop SC and experiment pass plans and procedures.
- Plan, manage, and execute pre-launch exercises and rehearsals.
- Participate in SV system testing, FCT and LBCT.
- Provide all support and deliverables IAW the agreed-upon RSC Readiness schedule.

3.2.4.2 Launch and Early Orbit (STEC)

- Conduct operations during launch and early orbit.
- Schedule AFSCN and other external resources.
- Execute pre-planned pass plans and procedures as specified in the L&EO timeline.
- Monitor real-time and stored SOH telemetry for out of limit conditions.
- Monitor real-time SOH telemetry and execute contingency procedures as required.
- With support of ST, spacecraft contractor, and experimenters, modify pass plans and mission control procedures to accommodate abnormal performance.
- Support anomaly meetings.

3.2.4.3 Normal Operations (STEC)

- Monitor real-time SOH telemetry and execute contingency procedures as required.
- Schedule X-Band and AFSCN data downloads.
- Notify the MDR, spacecraft contractor, and others as appropriate, in the event of on-orbit anomalies.
- Plan and execute anomaly recovery procedures as directed by the MDR.
- Perform SV trending.
- Provide experimenters and spacecraft contractor with data products specified in Section 7 and according to the GICD.

3.2.4.4 End-of-Life Operations (STEC)

- Execute the End-of-Life plan and safing/termination procedures.
- Provide end-of-mission report.

4 Commanding Requirements

4.1 Uplink Signal Characteristics

CMD01: *VO shall provide the sole command uplink to the spacecraft with the following signal characteristics: (STEC)*

Uplink Signal Characteristics

Center Frequency:	TBD MHz
Command tones:	S (65 kHz), 0 (76 kHz), 1 (95 kHz)
Bit Rate:	2 kbps (post encryption)
Modulation:	PM
Modulation index:	TBD
Encryption:	Cardholder

4.2 Commanding Characteristics

4.2.1 SGLS Command Format

CMD02: *VO shall format and transmit the following types of command: (STEC)*

a) Individually authenticated commands
b) Data mode block commands
c) Encryptor commands
d) GPS commands

4.2.2 Cardholder Operation

CMD03: *VO shall format commands to be accepted by the KI-17 encryptor using the Cardholder algorithm. (STEC)*

4.2.3 Spacecraft Commanding

CMD04: *VO shall develop a mission-unique command builder with the capability to format all commands in the spacecraft contractor-delivered command database. (STEC)*

CMD05: *VO shall build and manage command stored memory uploads containing time-tagged commands for later execution. (STEC)*

CMD06: *VO shall format spacecraft contractor-delivered software files into the appropriate format for upload. (STEC)*

4.2.4 Experiment Commanding

CMD07: *VO shall format Experiment 1 calibration table files (up to 1 Mbyte in size) into the appropriate upload format. (STEC)*

CMD08: *VO shall format Experiment 2 memory files into the appropriate upload format. (STEC)*

5 Telemetry Requirements

The RFPSat spacecraft has three downlinks: SGLS low-rate, SGLS high-rate and X-Band. The spacecraft can simultaneously transmit all three downlinks. The SGLS low- and high-rate downlinks are AFSCN-compatible in accordance with AFSCN SIS-000502. The SGLS low-rate telemetry will be used for downlink of real-time SOH. The SGLS high-rate telemetry will contain stored state of health in addition to Experiment 1 and 2 data. The X-Band downlink will contain Experiment 1 image data.

5.1 Downlink Signal Characteristics

TLM01: *VO shall process the SGLS low-rate telemetry stream with the following characteristics: (EDS)*
a) 128 kbps data rate
b) SGLS channel TBD, Carrier 1
c) Downlink encryption is Pegasus, which cannot be bypassed (no clear text downlink).

TLM02: *VO shall process the SGLS high-rate telemetry stream with the following characteristics: (EDS)*
a) 1.024 Mbps
b) Carrier 1 Base-Band (C1BB)
c) SGLS channel TBD, Carrier 1
d) Downlink encryption is Pegasus, which cannot be bypassed (no clear text downlink).

Detailed downlink signal characteristics between the spacecraft and the AFSCN will be documented by STEC in the Universal Documentation System (UDS) PRD and in the GICD.

5.2 Telemetry Characteristics

All SGLS downlink telemetry is frame-based and contains subcommutated data that is compatible with the RSC architecture. Each frame consists of 800 bytes for a total of 6400 bits per frame. A frame ID byte identifies the type of data contained in each frame. Frame counters and checksums are included in each frame for use in determining data quality. Details of the telemetry format will be provided in the GICD and Telemetry Handbook.

5.3 Real-time Telemetry Processing Requirements

Stored SOH and experiment data does not need to be displayed in real-time during a contact. Telemetry limits will be defined in the Telemetry Handbook. Operational actions based on these limits will be provided in the OOH.

TLM03: *VO shall receive SGLS low-rate and SGLS high-rate telemetry data from the spacecraft through the AFSCN. (STEC)*
TLM04: *For the SGLS low-rate telemetry, VO shall decommutate, Engineering Unit (EU)-convert and display each telemetry parameter in the Payload Test Center (PTC) whenever the PTC is active (normally during L&EO and anomalies only). (STEC)*
TLM05: *VO shall utilize the red and yellow limits provided in the Telemetry Handbook and display SGLS low-rate telemetry values in color on real-time telemetry displays. (STEC)*
TLM06: *VO shall develop graphical and/or text based displays for each subsystem. (STEC)*
TLM07: *VO shall dump and compare to a ground image, the on-board stored command memory. (STEC)*

5.4 Post-pass Telemetry Processing

After a satellite contact has occurred, telemetry data will be formatted and distributed to outside agencies. Specific format, distribution and archiving details will be specified in the GICD.

TLM08: *For the SGLS high-rate experiment telemetry, VO shall decrypt, remove SC-generated headers and footers and determine the data quality of the telemetry frame. (STEC)*
TLM09: *VO shall separate, format, and distribute experiment data files as specified in Section 7. (STEC)*
TLM10: *For SGLS high-rate stored SOH telemetry, VO shall decrypt, remove SC-generated headers and footers and EU-convert this data. (STEC)*
TLM11: *VO shall limit check all stored SOH telemetry points (with limits identified in the Telemetry Handbook) and generate a report identifying those points that exceeded red and yellow limits. (STEC)*

TLM12: *VO shall archive SOH and experiment data from both the SGLS low-rate and SGLS high-rate telemetry streams for a period of 30 days. (STEC)*
TLM13: *VO shall perform high-level subsystem trending on stored SOH data and provide monthly reports to spacecraft contractor. (STEC)*

6 Orbit management Requirements

6.1 Orbit Processing Requirements

The spacecraft will have a GPS receiver that can be used for orbit determination. In addition, the AFSCN Psuedo Random Noise (PRN) ranging capability is available.

OM01: *VO shall perform orbit determination (using either GPS or PRN ranging data) to generate antenna-pointing angles. (STEC)*
OM02: *For Experiment 1, VO shall provide ephemeris predictions with 10 km accuracy of in-track, cross-track and altitude position. This predicted ephemeris will be provided one week in advance of the monthly Image Mode event. (STEC)*
OM03: *For Experiment 3, VO shall provide an ephemeris prediction with 10 km accuracy of in-track, cross-track, and altitude 30 minutes prior to the release of the experiment. (STEC)*

6.2 Orbit Accuracy Requirements

OM04: *For Experiment 1, VO shall provide weekly processed ephemeris with an accuracy of 1 km altitude, and 5 km in-track and cross-track. (STEC)*

6.3 Orbit Maintenance Requirements

There are no orbit maintenance requirements.

7 Data Product Requirements

This section identifies the on-orbit data products that will be provided to each organization. VO (STEC) will provide products to ST, spacecraft contractor, and experimenters. For products provided to VO, the organization supplying the product will be identified in the source column. Items listed in each section are requirements.

7.1 Spacecraft Contractor Data Requirements

Product Type	Description	Source	Mission Phase	Frequency	Delivery Media	Archival Required?	Notes
1. Planning	24-hour planning products	VO	L&EO	As updated	Hardcopy or Electronic	Yes	RSC standard format and archiving is acceptable.
2. Planning	Pass Plans	VO	L&EO	Prior to every SGLS contact	Hardcopy	Yes	RSC standard format and archiving is acceptable.
3. Planning	Command Build Report	VO	L&EO	Prior to every SGLS contact	Hardcopy	No	To include commands and command memory uploads.
4. Post-pass	Out of Limit SV Telemetry Report	Stored SOH	L&EO and normal ops	2 hours after each pass where out of limit event occurred	Hardcopy or Electronic	Yes – 14 days	RSC standard format and archiving is acceptable.
5. Telemetry	EU-converted R/T SOH data	SOH	L&EO and normal ops	On-demand (normally within 2 hours, 30 minutes following anomaly)	Electronic	Yes – 30 days	RSC standard format and archiving is acceptable.
6. Telemetry	Decrypted raw SOH data	SOH	L&EO and normal ops	On-demand (normally within 6 hours, 30 minutes following anomaly)	Electronic	No	Provided in binary file format.
7. Telemetry	EU-converted SSOH data	Stored SOH	L&EO and normal ops	On-demand (normally within 6 hours, 30 minutes following anomaly)	Electronic	Yes– 30 days	RSC standard format and archiving is acceptable.

Product Type	Description	Source	Mission Phase	Frequency	Delivery Media	Archival Required?	Notes
8. Telemetry	Trending Plots	Stored SOH	L&EO and normal ops	Monthly	Hardcopy or Electronic	Yes – 30 days	Spacecraft contractor-provided trending system will be used to generate this product.

7.2 Experiment Data Requirements

Product Type	Description	Source	Mission Phase	Frequency	Delivery Media	Archival Required?	Notes
1. Planning	24-hour planning products	VO	L&EO	As updated	Hardcopy or electronic	Yes	RSC standard format and archiving is acceptable.
2. Planning	Pass Plans	VO	L&EO	Prior to every SGLS contact	Hardcopy	Yes	RSC standard format and archiving is acceptable.
3. Planning	Command Build Report	VO	L&EO	Prior to every SGLS contact	Hardcopy	Yes	To include commands and experiment uploads.
4. Post pass	Out of limit SV Telemetry Report	Stored SOH	L&EO and normal ops	After each pass where out of limit events occurred	Electronic or hardcopy	Yes	RSC standard format and archiving is acceptable.
5. Telemetry	Subset EU-Converted SOH data	SOH	L&EO and normal ops	After every contact (normally within 2 hours, 30 minutes following anomaly)	Electronic	Yes – 1 month	RSC standard format and archiving is acceptable.
6. Telemetry	Subset EU-Converted SSOH data	Stored SOH	L&EO and normal ops	After every contact (normally within 2 hours, 30 minutes following anomaly)	Electronic	Yes – 1 month	RSC standard format and archiving is acceptable.

Product Type	Description	Source	Mission Phase	Frequency	Delivery Media	Archival Required?	Notes
7. Telemetry	Binary Experiment data	High-rate SGLS	L&EO and normal ops	After every download (Experiment 1 Image Mode - within 6 hours, Experiment 1 Calibration Mode – within 24 hours, Experiment 3 – within 24 hours)	Electronic	Yes – 1 month	RSC standard format and archiving is acceptable.
8. Orbit	Ephemeris (predicted)	VO	Normal ops	Experiment 1, - one week prior to target image upload Experiment 3 - 30 minutes prior to experiment release	Electronic	Yes	RSC standard format and archiving is acceptable.
9. Orbit	Ephemeris (reconstructed)	VO	Normal ops	Experiment 1 - within one week	Electronic	Yes	RSC standard format and archiving is acceptable.

7.3 X-Band Provider Data Requirements

Product Type	Description	Source	Mission Phase	Frequency	Delivery Media	Archival Required?	Notes
1. Planning	X-Band Transmitter turn-on schedule	VO	LEO and normal ops	Weekly	Electronic	Yes	
2. Orbit	Ephemeris (predicted)	VO	LEO and normal ops	Weekly	Electronic	Yes	

7.4 VO Data Requirements

7.4.1 Products from Spacecraft Contractor

Product Type	Description	Source	Mission Phase	Frequency	Delivery Media	Archival Required?	Notes
1. Command	Spacecraft uploads	Spacecraft contractor	L&EO and normal ops	As needed	Electronic with Memogram	Yes	Will use VO tasking file format as specified in the GICD.

7.4.2 Products from Experimenters

Product Type	Description	Source	Mission Phase	Frequency	Delivery Media	Archival Required?	Notes
1. Command	Experiment 1 calibration table uploads	Experiment 1	Normal ops	Every 6 months, at least 1 week in advance	Electronic	Yes	Will use VO tasking file format as specified in the GICD.
2. Command	Experiment 1 target image uploads	Experiment 1	Normal ops	Monthly, 12 hours in advance of event	Electronic	Yes	Will use VO tasking file format as specified in the GICD.
3. Command	Experiment 2 memory uploads	Experiment 2	Normal Ops	Quarterly	Electronic or Hardcopy	Yes	Will use VO tasking file format as specified in the GICD.

8 Support Requirements

8.1 Facilities and Communications

8.1.1 Experiment Test Center Requirements

The normal VO operations concept for using the PTC during L&EO is acceptable. After L&EO, PTC access will be required for the Experiment 3 rehearsal, Experiment 3 release and any long-term anomaly support.

PTC workstations with telemetry display capabilities are required during L&EO, Experiment 3 rehearsal and release, and anomaly periods. Exact office space, PC access, phone lines, and LAN requirements are TBD.

SR01: *VO shall provide access to six workstations for viewing telemetry. (EDS)*
SR02: *VO shall provide one additional workstation for viewing commanding. (EDS)*
SR03: *VO shall provide PC access, phone lines, and administrative LAN connectivity for customer during PTC operations. (EDS)*

8.1.2 Other Workspace

SR04: *VO shall provide conference room space convenient to the PTC. (EDS)*

8.2 Administrative Requirements

None.

8.3 Customer-Provided Mission Unique Equipment / Software

SR05: *VO shall integrate into the RSC, the spacecraft contractor-provided trending tool. (EDS)*
SR06: *VO shall perform system administration functions on the spacecraft contractor-provided trending tool. (STEC)*

9 Space Vehicle Test Support Requirements

9.1 Integrated Systems Test

Integrated Systems Tests will be conducted at spacecraft contractor's facility in Colorado.

TST01: *VO shall obtain two separate recordings of spacecraft telemetry to use for mission software development, exercises, and rehearsals. (EDS)*
TST02: *VO shall send three MCT members to support / train during five days of space vehicle integration and test. (STEC)*

9.2 Factory Compatibility Test

Det 12/VO deployables will be required to support one FCT at the spacecraft contractor's facility in Colorado. This FCT will last five days and will occur in April 2006.

TST03: *VO shall participate in FCT by developing command procedures, sending commands, and processing telemetry received at the RSC. (STEC)*
TST04: *VO shall procure and maintain a communication link between the RSC and the spacecraft contractor's facility in Colorado to support FCT. (EDS)*
TST05: *VO shall provide the necessary SGLS RF capabilities to support the FCT. (EDS)*

9.3 Launch Base Compatibility Test

The goal of the LBCT is to show that compatibility between the SV and the RSC has been maintained since FCT, and that the space vehicle RF system has survived shipment to the launch base. LBCT will be conducted at Vandenberg AFB, California up to two months before launch. The test is scheduled for approximately five days.

TST06: *VO shall participate in LBCT by developing command procedures, sending commands, and processing telemetry received at the RSC. (STEC)*
TST07: *VO shall provide the necessary SGLS RF capabilities to support the LBCT. (EDS)*
TST08: *VO shall schedule an AFSCN link between the RSC and the LBCT site. (STEC)*

10 Training Requirements

10.1 RSC Training

The typical RSC process for exercises and rehearsal will be followed for this mission. All training will occur at the RSC.

TRN01: *VO shall participate in the Rehearsal Committee. (STEC)*
TRN02: *During rehearsals, VO shall provide three Rehearsal Engineers in addition to Rehearsal Evaluators to evaluate MCT performance. (STEC)*
TRN03: *In addition to the typical RSC exercises and rehearsals prior to launch, VO shall conduct a rehearsal simulating the release of the Experiment 3. (STEC)*

10.2 Space Vehicle Training

TRN04: *VO personnel shall attend two days of experiment training provided by the experimenters. (STEC)*
TRN05: *VO personnel shall attend three days of spacecraft training provided by the spacecraft contractor. (STEC)*

10.3 MUS/MUE Training

TRN06: *VO personnel shall attend one day of trending tool training provided by the spacecraft contractor. (STEC)*

11 Program Security Requirements

11.1 Information Security

The uplink is encrypted and downlinks are encrypted. Certain aspects of the encryption and decryption scheme used for RFPSat are classified in accordance with applicable regulations and instructions.

All spacecraft and experiment data to be handled by the RSC is unclassified, public access.

Appendix A – Acronym list

AFSCN	Air Force Satellite Control Network
CTH	Command and Telemetry Handbook
EDS	Engineering Development and Sustainment
EU	Engineering Unit
FCT	Factory Compatibility Test
GICD	Ground Interface Control Document
GMRD	Ground Mission Requirement Document
GSD	Ground Specification Document
IAW	In Accordance With
IPT	Integrated Product Team
LAN	Local Area Network
LBCT	Launch Base Compatibility Test
L&EO	Launch and Early Orbit
MCF	Mission Control Force
MCT	Mission Control Team
MDR	Mission Director Representative
MOWG	Mission Operations Working Group
OOH	On-Orbit Handbook
PC	Personal Computer
PM	Pulse Modulated
PRD	Program Requirement Document
PRN	Pseudo Random Noise
PTC	Payload Test Center
RDT&E	Research, Development, Test, and Evaluation
RF	Radio Frequency
RFP	Request For Proposal
RSC	RDT&E Support Complex
R/T	Real-Time
SC	Spacecraft
SGLS	Space Ground Link System
SOH	State of Health
SPO	Satellite Program Office
STEC	Space Test and Engineering Contract
STP	Space Test Program
SV	Space Vehicle
SVH	Space Vehicle Handbook
TBD	To Be Determined
TT&C	Telemetry, Tracking and Control
UDS	Universal Documentation System